

VIETNAM – WORKING TOWARD TO PRODUCE  
SAFE AND HIGH-QUALITY AQUACULTURE FOODS

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**Abstract**

The aquaculture sector plays an important role in the alleviation of poverty and the achievement of food security in many parts of the world. Aquaculture production of Vietnam has significantly contributed to national economy. Nowadays, market forces are exerting a strong influence on aquaculture development, particularly that of commercial and industrial aquaculture. Consumers in many developed and developing countries are becoming increasingly influential in and concerned about what they eat and at what cost food is produced, especially in the case of internationally traded products. Major importing region and countries have begun to set stringent standards and regulations to ensure quality and safety of aquaculture products and to reduce social and environmental impacts of the production. Vietnam-Aquaculture has also made progress in addressing sustainability problems through improved technology and further progress is achieved through improved management practices such as CoC, GAP, SQF, organic culture..... to produce safe and high-quality foods.

**I. Current situation of Vietnam aquaculture**

1.1 General figure of the aquaculture

Vietnam is one of the top aquaculture producers in the world (FAO, 2004). It has a large potential for aquaculture development with total area of water-surface estimated above 1.7 million hectares, of which nearly 1 million hectares have just been now exploited for aquaculture. During the last decade, since 1999, more than 377,000 ha of land have been converted into aquaculture

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<sup>1</sup> Key words: aquaculture, food safety, Viet Nam

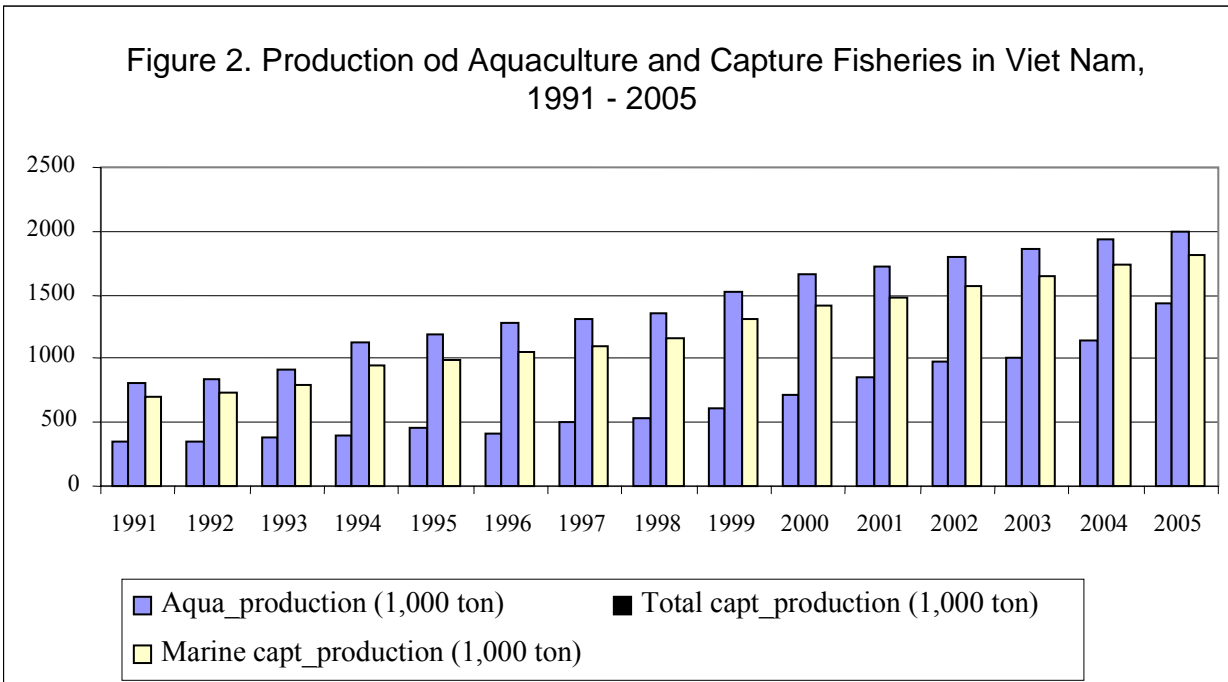
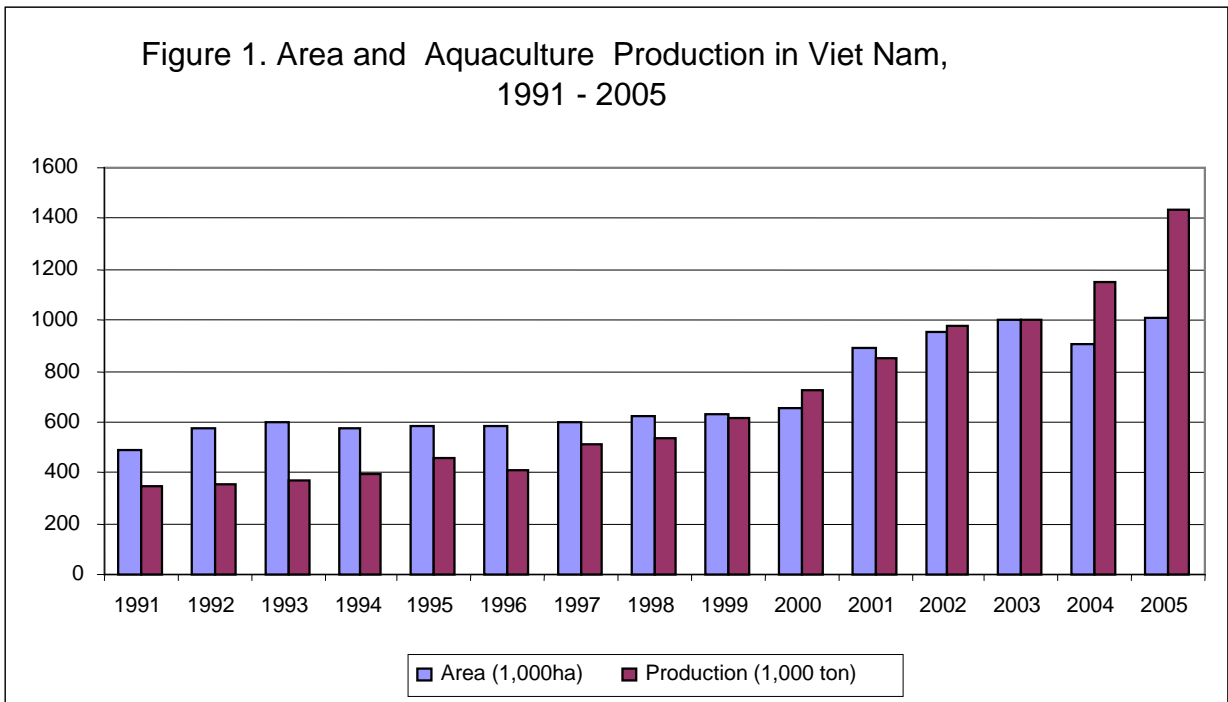
ponds, including 346,694 ha of low yield rice fields, 2,170 ha of salt pans and other uses due to the change of policies of government on the land uses. The Resolution issued by Vietnamese Government in 2000 allowed farmers to shift the low production rice field into shrimp ponds. Consequently, the area and production of aquaculture have steadily increased for the last ten years (table 1.), especially as the aquaculture products in Viet Nam can be exported to various foreign markets such as USA, EU, Japan,....

Table 1. The area and production of aquaculture in Viet Nam during 1999 – 2005

Year	1999	2000	2001	2002	2003	2004	2005
Area (ha)	524,619	640,495	755,178	797,744	867,613	920,088	959,900
- Marine & Brackish water		397,100	502,200	556,100	612,800	642,300	677,200
+ Fish culture		50,000	24,7000	14,300	13,100	11,200	16,500
+ Shrimp culture		324,100	454,900	509,600	574,900	598,000	616,900
+ Others		23,000	22,600	32,200	24,800	33,100	43,800
- Fresh water		244,800	253,000	241,600	254,800	277,800	282,700
+ Fish culture		225,400	228,900	232,300	245,900	267,400	272,100
+ Giant prawn culture		16,400	21,800	6,600	5,500	6,400	6,500
+ Others		3,000	2,300	2,700	3,400	4,000	4,100
Production (1,000 ton)	480.77	589.60	709.89	844.81	1,003.10	1,202.49	1,437,36

The figures show a rapid aquaculture development both in area and production in terms of annual growth. Aquaculture production is mainly coming from freshwater aquaculture (about 55%), especially the aquaculture industry of river-catfish while the export value is mainly coming

from marine and brackish water aquaculture, especially the shrimp farming industry due to their very high value (Table 2).



(Source: Evaluation of Aquaculture Development Program in the period of 2000-2005 and solutions to the year of 2010, Ministry of Fishery, 2006).

Table 2. Aquaculture production classified by groups (Ministry of Fishery, 2006)

No.	Items	Unit	In 2005
1	Total area for aquaculture	Ha	959,945
2	Total aquaculture production	Tons	1,437,350
	Of which:		
	- Brackishwater shrimp	tons	324,680
	- Marine fish	tons	3,510
	- Mollusk	tons	114,570
	- Seaweed	tons	20,260
	- Freshwater prawn	tons	6,400
	- Other freshwater aquaculture	tons	952,470
	- Others	tons	85,270
3	Export value	1,000 USD	1,627,301
4	Employees	person	2,550,000

*(Source: Evaluation of aquaculture development Programme in the period of 2000-2005 and solutions to the year of 2010, Ministry of Fishery, 2006).*

Geographically, the largest production of aquaculture mainly comes from the Mekong Delta (63 – 69% of total production - Table 3). It proves the important role of the Mekong Delta in contribution of the fisheries value to the country economics.

Table 3. The production of aquaculture by geographical regions of the country ( in %)

Geographical regions	1995	2001	2002	2003	2005
Red River Delta	13.6	17.5	17.6	16.5	15.0
North – East Area	2.8	3.7	4.6	4.0	3.1
North – West Area	0.5	0.4	0.5	0.5	0.4
North Central Coast	4.1	4.6	4.6	5.3	4.3
South Central Coast	1.8	2.7	2.2	2.0	1.8
Central Highlands	1.0	1.1	1.2	1.1	0.7
South – East Area	7.5	7.3	7.8	7.3	6.3
Mekong Delta	<b>68.7</b>	<b>62.7</b>	<b>61.5</b>	<b>63.1</b>	<b>68.4</b>
Total	100	100	100	100	100

(Source :Statistics General Department, 2006)

During 1995 – 2005, the structure of culture species was also largely changed to the market orientation. Besides the species which have been reared for exporting such as shrimp, catfish, lobster, tilapia, grouper, mud crab,... or indigenous fish for domestic consumption, some other aquatic animals such as: soft shell turtle, frog, snails,... have been also cultured.

From table 4, the data show that so far, black tiger shrimp and catfish have still been the main aquaculture products in Viet Nam due to their high export value to various foreign markets.

Table 4. Area and Production of main species of aquaculture (in 2005)

	Area (ha)	%	Production (1,000 tons)	%
Total	959,945	100	1,437.356	100.0
Black tiger shrimp			324.68	22.6
	604,479	62.90		
White shrimp			5.57	0.4
Local shrimp			3.40	0.2
Giant prawn	9,847	1.03	6.40	0.4
Catfish	4,912.5	0.51	375.50	26.1
Tilapia	2,148	0.22	24.00	1.7
Clam	14,000	1,56	114.60	8.0
Others				40.6

*(Source: Report on aquaculture in 2005, Ministry of Fisheries)*

## 1.2 Contribution of aquaculture to the Gross Domestic Production of the country:

Based on the value of aquaculture and capture fisheries described in table 5, we can see that the value of aquaculture steadily increased from 0.2% of total GDP in 1996 to 5.78% in 2005, whereas the contribution of capture fisheries value to the country GDP was diminished from 5% to 4% for last 10 years. Therefore, the production of aquaculture has played important role in the increase of export value of the fisheries sector, annually from 697 million US\$ in 1996 to 2,650 million US\$ in 2005 (Table 6).

Table 5. The value of Aquaculture in the Country Gross Domestic Production

Year	Total GDP of the country ( billion US\$)	Value of Aquaculture ( billion US\$)	In percentage (%)	Value of Capture Fisheries ( billion US\$)	In percentage (%)
1996	21.38	0.46	2.14	1.1	5.05
1997	23.12	0.48	2.06	1.2	5.01
1998	24.46	0.51	2.08	1.2	4.83
1999	25.63	0.56	2.19	1.3	4.93
2000	27.37	0.79	2.88	1.4	5.08
2001	29.25	1.12	3.82	1.4	4.85
2002	31.32	1.31	4.18	1.4	4.63
2003	33.62	1.58	4.71	1.5	4.39
2004	36.24	1.90	5.26	1.5	4.25
2005	39.30	2.27	5.78	1.6	4.04

(Source :Statistics General Department, 2006)

Table 6. Export Value of Fisheries Products

	1992	1996	2000	2001	2002	2003	2004	2005
Export value of Fisheries (million US\$)	308	697	1,479	1,778	2,023	2,200	2,397	2,650
Growing rate (%)		12.1	57.5	20.2	13.8	8.7	8.98	10.55
% of total export value of the country	11.9	9.6	8.7	10.3	11.0	9.6	9.04	8.28

(Source :Statistics General Department, 2006)

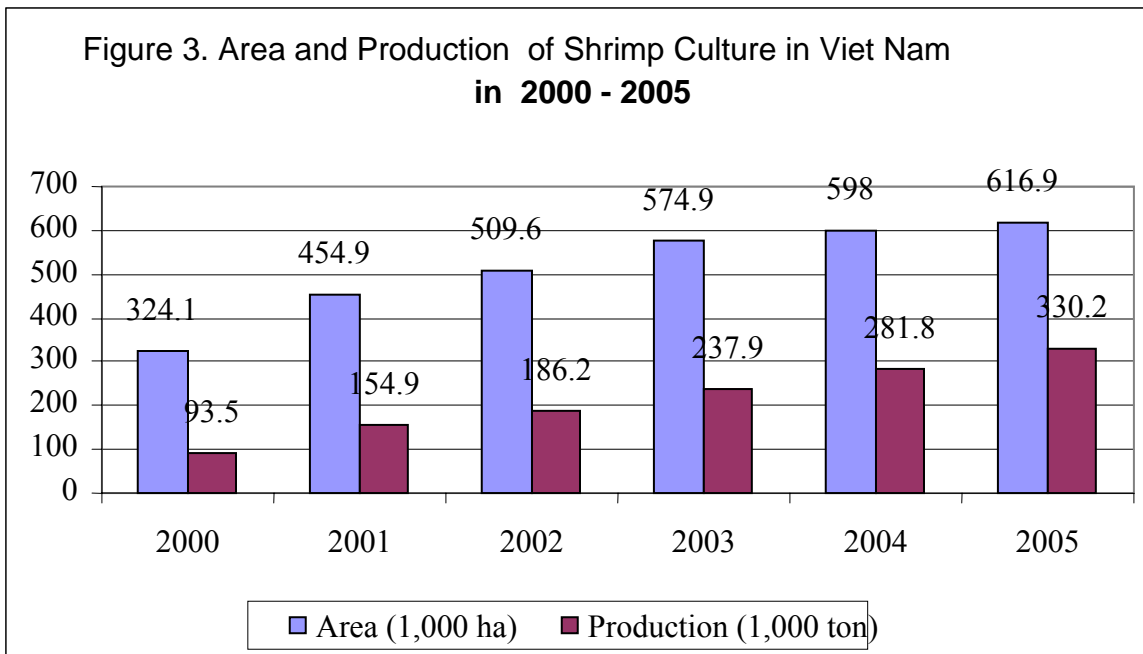
### 1.3 Major aquaculture production:

Among various fish and shrimp species which are being raised now in Viet Nam, two key species giving the largest production as well as export value are black tiger shrimp (*Penaeus monodon*) in the brackish water and river catfish (*Pangasianodon hypophthalmus*) in fresh water. Their production accounts for approximate 50% of the total production of aquaculture in Viet Nam.

#### 1.3.1 Brackish water shrimp

Black tiger shrimp (*Penaeus monodon*) is a key species of the shrimp farming industry and mainly practiced in coastal provinces. Diversified approaches are applied in shrimp farming including earthen-pond shrimp farming, rice-shrimp farming, mangrove-shrimp farming, etc. with various levels of intensive, semi-intensive, improved extensive and extensive farming. Brackish Shrimp farming area was 210,448 hectares in 1999, 283,610 hectares in 2000, 448,996 hectares in 2001, 489,475 hectares in 2002, 555,593 hectares in 2003, 592,805 hectares in 2004, and 604,479 hectares in 2005 with a yearly average increase of 31.2%. Shrimp farming industry is mainly practiced in the Mekong River Delta that accounted for 535,145 hectares in 2005 in total shrimp farming area of 604,479 hectares of the country. Parallel with an increasing of shrimp farming area is an increasing in shrimp production, accounted for 63,664 tons in 1999 and 324,680 tons in 2005 of which major production (around 290,000 tons) is coming from black tiger shrimp (*Penaeus monodon*).



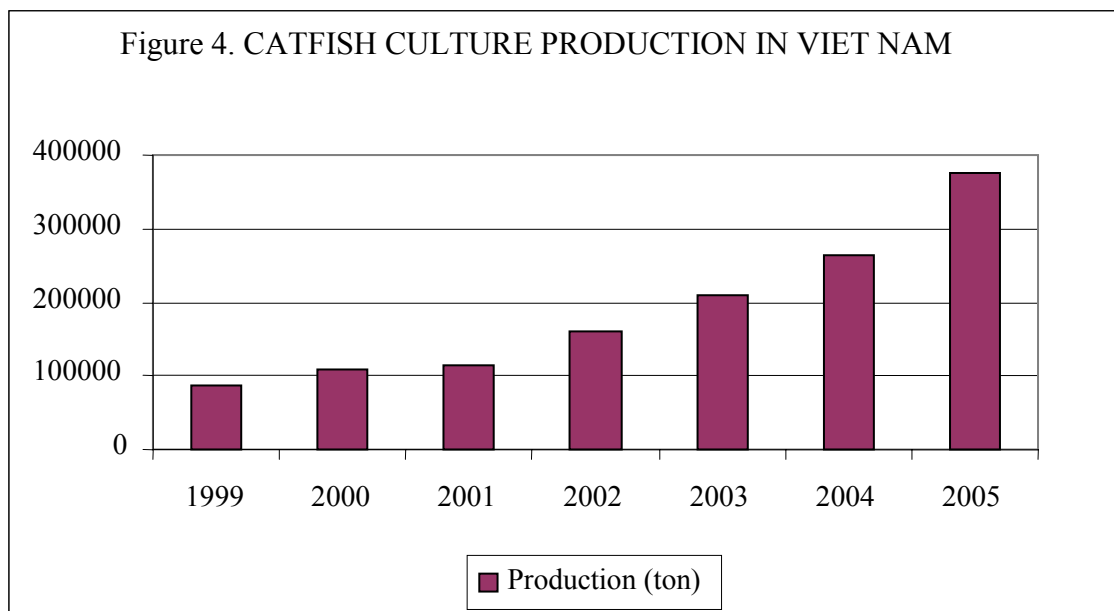


### 1.3.2 Catfish culture:

The catfish (*Pangasianodon hypophthalmus*) has been traditionally cultured in the Mekong Delta in Viet Nam since 1950s in small scale, mainly for subsistence. The farmers collected the fish larvae from the Mekong River during early flood season. The larvae were nursed in small ponds and provided to local farmers to stock in the integrated farming system: Ponds/channels – Husbandry – Garden. The fish was consumed by households or sold to local markets. However, in 1990s the catfish culture developed quickly as commercial products because:

- Catfish products could be exported to the foreign markets as USA, Australia,.. and EU, Japan, China recently.
- The success in induced reproduction of catfish. For the time being, all the fingerlings come from the hatcheries and farmers can actively stock fingerlings in the earlier or later time to reduce pressure of the massive harvest.
- The culture techniques: feed, water management, pond design have been improved with high intensification. The yields can reach 350 -400 tons per hectare per crop in

pond or 100 - 150 kg/m<sup>3</sup> in cages. Additionally, the farmers have shifted from culture of catfish in cages in the rivers to pond systems producing higher quality (“white color”) of fish product which meets requirement for exporting markets.



During the last five years, the catfish production has increased from 86,700 tons in 1999 to 375,500 tons in 2005 and catfish is the key species cultured in freshwater area for exporting to other countries, but so far the fish has been only raised in the Mekong Delta where the water conditions, feed, seed are relevant and available.

#### 1.4 Government Organizations and Support Service for Aquaculture:

In Viet Nam, the Ministry of Fisheries is responsible for management and development of national fisheries, in which aquaculture is included. Concretely, the Department of Aquaculture of MoFi is the key organization for setting up policies, strategies and planning for aquaculture development whereas the National Fisheries Extension Center is the national organizations responsible for aquaculture extension services and implementation of national projects of aquaculture technologies transfer.

At the local level, there are Fisheries Extension Centers, which are belonging to the Provincial Department of Fisheries (coastal provinces) or Department of Agriculture and Rural Development (inland provinces). These provincial Extension Centers sequent coordinate with a network of extension officers (district level) and extension workers/farmers (village level) for support services for transfer of aquaculture technologies to farmers.

#### 1.5 Legal framework for Aquaculture:

In order to exploit the potential of aquaculture in Viet Nam to meet requirements for socio-economic development of the country, the basic documents have been promulgated by the Government as legal framework for aquaculture:

- a. Decision No. 224/1999/QĐ – TTg dated 8/12/1999 by the Prime Minister for approval of the Plan of Aquaculture Development from 1999 – 2010 with the objective:” To ensure food security for people and supply fisheries materials for export”. In which, the following outputs must be achieved by the year of 2010:
  - Production of 2 million tons of fish and other aquatic animals ,
  - Export value from aquaculture products: 2.5 billion US\$
  - Supplying employment to 2 million persons.
- b. The Resolution No. 09/2000/NQ-CP dated 15 June 2000 on policy of restructure of land uses in which the Government allows farmers to change some areas of low production rice fields, salt pans and some other cultivated land into aquaculture.
- c. Fisheries Law was issued by Vietnamese National Assembly on 26/11/2003, in which the aquaculture activities are stipulated by articles 23 – 26 of Chapter IV.
- d. Decision No. 10/2006/QĐ-TTg dated 11 January 2006 by the Prime Minister for approval the Master Plan for Fisheries Development to year 2010 and the Vision 2020, in which the objectives of the plan are: “The production of aquaculture in 2010 will be about 2 million tons, including 0.98 million tons from fresh water aquaculture and 1.02 million tons marine

and brackish water aquaculture; 1.1 – 1.4 million hectares of water bodies will be exploited for aquaculture activities, of which there are 0.6 million hectares of freshwater area and 0.7 million hectares of brackish water and marine areas”. The details of plan of aquaculture development until 2010 by MoFi is described as follows:

No.		Units	In 2006	In 2010
1	Area of aquaculture	Ha	980,000	1,100,000
2	Total production:	Ton	1,488,00	2,1000,000
	- Shrimp	Ton	350,000	400,000
	- Marine fish	Ton	15,000	200,000
	- Mollusk	Ton	200,000	380,000
	- Sea weeds	Ton	35,000	50,000
	- Giant prawn	Ton	10,000	60,000
	- Freshwater fish	Ton	838,000	938,000
	- Other aquatic animals	Ton	40,000	72,000
3	Seed supply			
	- Catfish	Million	500	700
	- Shrimp	Billion	32	35
	- Marine fish	Million	2	400
4	Exporting value	1,000 USD	1,700,000	2,500,000

In order to achieve the above outputs, the following strategies of aquaculture development have been set up by MoFi:

- The black tiger shrimp is still the main species for aquaculture for the large brackish water area.

- The development of aquaculture must be based on the overall, regional and local planning. (In some province, the government and local farmers just want to increase production year by year but without considering a lot of risks because of lacking facilities and conditions necessary).
- Increase of the production of aquaculture must be directed to the improvement of yields and product quality; introduction of high value species to farming and assurance of food safety and low cost.
- Development of various farming systems that correspond to specific ecological zones and produce organic culture products targeting to foreign markets.

## **II. Improved technologies and improved management practices to produce safe and high-quality aquaculture foods**

The sustainable development of aquaculture to provide safety and high quality aquaculture foods is toward trend of global aquaculture due to major issues concerning international trade in fish/shrimp and other aquatic products that have been prominent in recent years, including changes in quality and safety control measures in the importing countries; the introduction of new labeling requirements and the concept of traceability in major markets in developed countries. Environmental friendly aquaculture and organic aquaculture together with good management practices have therefore raised in several countries.

The Government has realized the hazards in parallel with the intensification of aquaculture. Therefore as the area of intensive farming systems is expanded, the hazards of water pollution, outbreak of diseases, food quality and safety also increased. It is important that the policy makers and farmers must be aware of the above issues in order to manage them. With the aim to closely manage food safety for sustainable development in aquaculture, the authorities

must have regulations and control system to manage quality of seeds, rearing procedure, chemicals/antibiotics utilized in aquaculture.

The MoFi has considered introduction of organic culture, the CoC , GAP, BAP, .... into aquaculture is the most appropriate approach for sustainable development of aquaculture in Viet Nam with conditions for food safety and traceability of food products.

The following aquaculture technologies have been introduced to Viet Nam to meet requirements of food quality and safety control of the international as well as domestic markets

## 2.1 Organic aquaculture

### a) Organic shrimp farming in Vietnam:

Organic aquaculture was first introduced to Viet Nam in 1999 and was determined by the Vietnamese Government as one of strategic direction for development of sustainable and responsible aquaculture. The Swiss Import Promotion Program (SIPPO) in cooperation with the Fisheries Department of Ca Mau province established the first organic farming system of tiger shrimp in Ca Mau. The SIPPO & MOFI project (2003 – 2006) with the overall objective that is to secure the livelihood of small producers of shrimp and to protect the environment by implementing standards for organic aquaculture within an extensive farming system .

The specific objectives:

- To master the artificial reproduction of the tiger shrimp within the controlled environment;
- To set up a brood-stock production system on an experimental scale and to implement technology transfer of this to allow Vietnamese producers to assure their future;
- To introduce organic certification of the pilot hatcheries in Ca Mau province and thus to supply the organic shrimp farms with the appropriate post larvae.

The farms were certified by Naturland, the German organic certification body. One of the requirements for the farming system is that 70% of the total farm area must be covered with the mangrove. And the first batch of organic shrimp was exported to Europe in 2002 with the price of 20% higher than the market prices.

Various criteria were introduced in the setting up of organic forestry-shrimp farming model (Dung, 2004):

- Site selection and protection of mangrove: the mangrove forest must be maintained on at least 70% of the total farm area.
- Protection of ecosystems in the farm and surroundings: Destruction or damage to the mangrove forest is not permitted. The water quality shall be monitored.
- Only native species stocked: Postlarvae of black tiger shrimp are stocked in ponds and passive seeding of the ponds with the larvae of native species entering the pond naturally with tidal flow is permitted.
- Breeding (experimental and nursery ponds): Reproduction should be in the most natural way possible. Measures for increased productivity of the rearing ponds are recommended.
- Pond design and water quality: Pond design should be adequate for efficient operation. Heating or aeration of ponds is not allowed.
- Tidal flow must be used for water exchange.
- Fertilization of grow-out ponds: The use of organic wastes as raw material or compost produced by the farm itself is authorized.
- Feeding in ponds: The use of external feed is not allowed (except for on-farm organic wastes).
- Stocking density of ponds: Actual seeding density of the ponds is about 2 post larvae/ m<sup>2</sup>.

- Safeguarding health and hygiene in ponds: Any disease preventive measures should rely on the use of probiotic microorganism. Antibiotics and chemotherapeutics are not permitted.
- Harvesting and processing: Care must be taken during harvesting to maintain shrimp quality, and processing of the shrimp must be according to organic principles.
- Social aspects: The livelihood and welfare of the farmers and their families must be looked after.

The farmers rear *Penaeus monodon*, *Metapenaeus ensis*, *Metapenaeus lysianassa* and *Penaeus indicus*. Farming methods are very extensive and stocking density very low (2-3 shrimps/m<sup>2</sup>). Only *P. monodon* post larvae are bought from hatcheries, other species come naturally from the wild. The shrimp nourish themselves on natural food produced by mangrove forest and no additional feeding is done. No chemical fertilizer is used by the farmers. The shrimps are produced according to a traditional systems using tides to seed and harvest the ponds. Every 15 days ponds are emptied during low tide and filled and seeded with wild shrimp post larvae during the high tide. During the recruitment, the sluice gate is opened to let the shrimp post larvae in. A net is placed during recruitment at the front of the gate to avoid predators coming in and at the same time to catch wild fishes and wild shrimps. At low tide a net is placed with its opening facing the ponds to harvest the biggest farmed shrimps. Harvest and seeding occur for three to five days during spring tide and the cycle is repeated throughout the year. The productivity of the ponds is low (150-200 kg/ha/yr), assuring though an excellent quality of product and minimal impact on the environment. Around 700 farms have been reported in 2004 that have been successfully inspected by IMO and re-certified by Bio Suisse and all the products was exported to Switzerland (Olivier, 2004).

b) Organic river catfish (*Pangasianodon hypophthalmus*):



Organic or ecological river catfish has been practiced in pens by AFASCO Company in An Giang province cooperated with BinCa Seafood company in Germany. This is done by penning off a large area and producing organic river-catfish in the confined area with natural flow thorough. Fish fries for organic river catfish culture must be free for antibiotic residue and pass the nursing period 40-60 days before stocking for grow-out with stocking density of 10 fish/m<sup>3</sup>. Feed including 50% rice bran, 25% soybean, 25% fish meal (organic certified materials). The culture procedure and requirements are strictly inspected by IMO (Institute for Marketecology) to get certificates from Naturland Organization in Germany for organic products. This activity is predicted to have very good future prospects. 300 tons of organic catfish was produced in 2005 and exported to Binca SeaFood Company and a amount of 1,600 tons of organic catfish will be produced in 2006. However, organic river culture of catfish in Viet Nam still encounters the following difficulties:

- Materials for feed in compliance with organic criteria such as rice bran (produced from local rice race without chemical utilization), soybean cake (residue), fish meal,... are not enough or available in Viet Nam. Most of them are now imported from other countries.
- Pellet feed for organic culture have not been produced by suppliers due to small scale farming.

c) Other organically farmed species:

The aquaculture of some species practiced in natural way in which the animals utilize natural foods is also considered as organic aquaculture. One of the new species that is being cultured organically is the freshwater prawn *Macrobrachium rosenbergii*. The culture of this species began in An Giang province which is subjected to flooding period of time every year. The flooding period can be exploited to farm the freshwater prawn farming and other fish species and the floods can bring benefits to the farmers instead of just causing them losses. The seeds need

to be produced earlier before the flooding season and reared in secure place; during the flooding season they can be introduced to suitable facility for grow-out.

Another organic farming activity is that of rice-shrimp. This takes place in Soc Trang, Ca Mau, Bac Lieu, Kien Giang and some other provinces in the Mekong Delta; These provinces has distinct dry and rainy seasons. During dry season, seawater penetrates up the delta, allowing shrimp farming to be carried out. On the other hand, during rainy season when the water is fresh, rice can be cultivated. Thus, we have both organic shrimp and rice.

## 2.2 Environmental friendly aquaculture

- Extensive and improved extensive shrimp farming occupies 90% of the total shrimp farming area. Extensive shrimp farming in very large ponds up to hundreds of hectares with low stocking density, less artificial feed and without chemical treatments, etc. is considered the as environmental friendly aquaculture that reduce the impact on the environment and also produced better quality shrimp.
- Rice-fish culture has also become traditional activity of the farmers in the Mekong River Delta, especially in the unflooded or controlled flooding areas (with water depth of 0.5-1.0 m during flooding season). The local species such as silver barb (*Barboides gonionotus*), skin gouramy (*Trichigaster pectoralis*),.... or common carp (*Cyprinus carpio*), Indian carp... are suitable species with best performance in rice-fields. A positive impact on the rice-field bed and soil fertility is also observed as the grazing and scavenging activities of the fish which reduced costs of weeding as well as for fertilizing during the next crop.
- The culture of mud-crab in mangrove farming system: Stocking density for grow-out is very low, estimated around 0.5 to 1 juvenile per m<sup>2</sup>. Partial harvest of commercial crab at size of above 200 gr/crab can be commenced after 80 to 90 days since stocked

and taking 2 months to finish the harvest. The production of the farming system ranged from 500 to 1,311 kg/ha/crop with survival rate obtained 29 to 68%.

### 2.3 Improved management practices

Parallel with the movement of aquaculture technologies toward producing safe and high quality aquaculture foods, the training and transfer of farm management practices to the farmers have also been implemented via governmental and overseas supported projects. Good Aquaculture Practices (GAP), Best Aquaculture Practices (BAP), Code of Conduct (CoC) (or Best Management Practices - BMP) all these management practices are considered as improved management practices which have been transferred to the farmers in several coastal provinces, especially to the people involved in shrimp farming and river-catfish culture. Different standards are also determined for these management practices to distinguish different quality products and market requirements:

Table 7. Criteria for different safe and high quality aquaculture foods.

Criteria	Naturland	BAP	GAP and CoC
Security	-Stock origins need to be certified as organic stock; -Natural breeding without using hormone. -At least 2/3 of the cycle are produced under Naturland standards	- Artificial seed is allowed. - External feed is allowed at the beginning of the culture.	
Chemicals and drugs	Chemicals, pesticides, insecticides, antibiotics are not allowed.	Some of the chemicals are allowed.	
Feed	Must be organic certificated	Organic certificated is not requested.	

The MoFi has put a lot of efforts on the transferring these management practices to the farmers to ensure Vietnam-aquaculture foods can enter the world markets such as Japan, US, and Europe.

Co-management is considered as the most appropriate approach for improvement of management of the aquaculture area for reducing risks on diseases and environment impacts. Within the framework of MRC project (2003 – 2005), Co-management in shrimp culture through shrimp farmer club in Soc Trang province was set up with the following activities:

- To provide farmers with water quality kit and train them how to measure and manage water quality of the shrimp ponds.
- To organize training courses on health management of shrimp ponds.
- To improve the awareness of farmers of fisheries regulations related to environment protection, food safety,....
- To help farmer club to set up the action plan for their activities and monthly monitoring.

The project has made the progress in strengthening the participatory preparation and implementation of management plan, management capacity of local authorities and farmers. As outputs, the awareness of local farmers about risks of utilization of chemicals on food safety and environment, and knowledge on “clean” aquaculture product were enhanced.

In 2003, the MoFi launched a case study project “ Application of GAP in black tiger shrimp culture at an area of 40 ha in Ben Tre province” funded by USA Embassy in Ha Noi and carried out by National Fisheries Quality Assurance and Veterinary Directorate (NAFIQUAVED). In 2004, based on initial outputs of the above project, the MoFi started the other project “ Application of GAP for sustainable development of shrimp culture in Viet Nam”

(2004 – 2006) which was also implemented by NAFIQUAVED with the objectives: (1) to supply cultured shrimp materials compatible with food safety requirement of international as well as domestic markets; (2) to reduce risks of shrimp disease out- breaks and environmental pollution, and to increase benefit for sustainability of black tiger shrimp culture in Viet Nam.

In the framework of the project, 5 areas of intensive and semi intensive shrimp culture in different ecological regions from the north to the south of the country have been selected for introduction of GAP, in which the following issues have been monitored and analyzed:

- Pathogens of shrimp diseases and their transmit.
- The hazards of chemicals, antibiotics and organic pollution on the environment.
- Control of risks from water supply, feed, utilization of chemicals and antibiotics to the shrimp food quality.
- To control the quality of seed, water quality and practices of integrated pond management.
- Introduction of co- management with the participation of local farmers through Management Body of the shrimp culture areas or GAP Management Group for Shrimp Culture Enterprise in conformation to the regulations on environment protection, GAP Guidelines, and in sharing experience and information of shrimp culture,..

After two years of the implementation, as outputs it is realized that the awareness and understandings of farmers about GAP and application of GAP have increased in the project areas. The utilization of chemicals and antibiotics reduced from 30 – 60% of the former quantities by farmers and enterprise owners and there were new diseases outbreak and high quality of shrimp products. Presently, all the outputs of the project are being documented by the government for further extension to other regions.

In connection with catfish culture, in 2002, the SQF 1000<sup>CM</sup> was introduced to the An Giang province where the largest quantity of catfish culture have been produced. With the support from SGS Company local authorities started this Program with the aims to produce catfish products compliant with requirement of food safety for export as well as domestic consumption. The Program includes 10 steps were applied at the catfish culture clubs. In 2005 19 catfish farms of AGIFISH Company was certified to meet the SQF1000<sup>CM</sup> for their production and in 2006 the Provincial Breeding Center for Aquaculture and its 7 satellite hatcheries were also certified for SQF 1000<sup>CM</sup> in An Giang.

### **III. Emerging needs and future directions**

Globalization and further liberalization of the world fish trade, while offering many benefits and opportunities, also present new safety and quality challenges. Emerging needs need to be set up to keep the aquaculture sustainability and aquaculture foods accepted by the world markets. Fish safety regulators need to apply a host of control measures, from mandating the use of the Hazard Analysis and Critical Control Point (HACCP) system to increasing testing, with varying degrees of success. Improved risk-based scientific tools must be adopted so that the fish safety standards reflect the most current and effective scientific methods available to protect public health.

Emerging aquaculture regulations is the obligation to acquire permits or licenses to establish a farm. These give farmers the right to establish and operate aquaculture facilities and at the same time allow governments to monitor the environmental sustainable development of aquaculture and to impose conditions that compel farms to be operated toward this end.

Encourage farmers to farm organic and environmental friendly aquaculture and in addition to that the apply of GAP, CoC, PMB in intensive aquaculture to ensure aquaculture foods coming from all farming technologies are safe and high quality that accepted by the world market.

At the national level also, aquaculture policies should be established to stimulate development. Government should intervene at the macro level by designating aquaculture as priority area in national economic agendas, defending goals and targets and establishing guiding strategies to achieve them. Government should also facilitate reasonable access to credit, provided fiscal incentive and removed instructional constrains (e.g. by establishing effective aquaculture administrative frameworks). At the micro or farm level, government has to intervene with start-up policies such as financing research, providing stocking materials and extension and advisory services, and, in some instance providing loans. Government needs also encourage the aquaculture sector through market promotion policies, the development of new-value added products and the regulation of aquatic food safety. In addition to the regulations relating to chemicals, antibiotics and feed used in aquaculture, special regulations need also issue on the processing and packaging of aquaculture products to prevent health hazards and safeguard consumers.

In order to assure the sustainable development of aquaculture, the co-management is considered as the most appropriate approach for management of aquaculture areas with conditions for producing safe and high quality aquaculture foods.

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